Lloyd's Register

Rules and Regulations for the Manufacture, Testing and Certification of Materials, July 2012

Notice No. 1

Effective Date of Latest Amendments:

See page 1

Issue date: November 2012

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RULES AND REGULATIONS FOR THE MANUFACTURE, TESTING AND CERTIFICATION OF MATERIALS, *July 2012*

Notice No. 1

This Notice contains amendments within the following Sections of the *Rules and Regulations for the Manufacture, Testing and Certification of Materials, July 2012*. The amendments are effective on the dates shown:

Chapter	***Section***	***Effective date***
3	1, 6, 7, 9	1 January 2013
3	2	Corrigendum
4	1	Corrigenda
5	1	Corrigendum
8	1	1 January 2013
8	1	Corrigenda
10	2	Corrigenda
12	2	1 January 2013

It will be noted that the amendments also include corrigenda, which are effective from the date of this Notice.

The *Rules and Regulations for the Manufacture, Testing and Certification of Materials, July 2012* are to be read in conjunction with this Notice No. 1. The status of the Rules is now:

Rules for Materials	Effective date:	July 2012
Notice No. 1	Effective date:	1 January 2013 & Corrigenda

Chapter 3

Rolled Steel Plates, Strip, Sections and Bars

Effective date 1 January 2013

Section 1
General requirements

1.3 Manufacture

1.3.1 All materials are to be manufactured at works which have been approved by LR for the type and grade of steel which is being supplied and for the relevant ~~steelmaking~~ steel-making and processing route.

1.5 Dimensional tolerances

1.5.3 For materials of nominal thickness 5 mm and more intended for hull structural purposes as detailed in Sections 2, 3 and 10, the minus tolerance on thickness of plates, strip and wide flats is 0,3 mm, irrespective of nominal thickness. For wide flats, this applies only where the width is greater than or equal to 600 mm. The average thickness of a product or products is not to be less than the nominal thickness. For ~~thickness~~ thicknesses below 5 mm, the thickness tolerances are to be specially agreed. Plus tolerance is to be in accordance with a National or International standard.

1.5.11 (*Part only shown*)
The average thickness and thickness tolerance is to be measured at locations of a product or products as defined below:

(b) At least two lines among Line 1, Line 2 or Line 3, as shown in Fig. 3.1.1, are to be selected for the thickness measurements and at least three points on each selected line as shown in Fig. 3.1.1 are to be selected for thickness measurement on each piece rolled from a single slab or single ingot. If more than three points are taken on each line, then the number of points shall be equal on each line.

CORRIGENDUM

Section 2
Normal strength steels for ship and other structural applications

2.2 Manufacture and chemical composition

(*Part only shown*)

Table 3.2.1 Chemical composition and deoxidation practice

NOTES
5. Where additions of any other elements are made as part of the ~~steelmaking~~ steel-making practice, the content is to be recorded.

Effective date 1 January 2013

Section 6
Ferritic steels for low temperature service

6.4 Mechanical tests

6.4.1 For plates, ~~a tensile test specimen is to be taken from one end of each piece when the mass does not exceed 5 tonnes and the length does not exceed 15 m. When either of these limits is exceeded,~~ tensile test specimens are to be taken from both ends of each piece. A piece is to be regarded as the rolled product from a single slab or from a single ingot if this is rolled directly into plates.

Section 7
Austenitic and duplex stainless steels

7.5 ~~Through thickness tests~~ Metallographic examination for sigma phase

~~*7.5.1* Where material will be strained in a through thickness direction during welding or in service, through thickness tests are required on plates over 10 mm thick in all the grades of steels listed in Table 3.7.1, apart from Grades 304L, 304 LN, 321 and 347.~~

7.5.1 The microstructure of all grades listed in Table 3.7.1 are to be examined metallographically at x400 magnification to demonstrate that sigma phase remains below 0,1 per cent of the observable area at a frequency of one per heat.

~~*7.5.2* Testing is to conform with the requirements of Section 8, with the exception given in 7.5.3.~~

~~*7.5.3* When the reduction in area is less than 35 per cent, metallographic or other evidence is required to show that no significant amount of any detrimental phase, such as sigma, is present.~~

Section 9
Bars for welded chain cables

9.5 Embrittlement tests

9.5.2 Each heat of steel bars of grades R3S, R4, R4S and R5 is to be tested for hydrogen embrittlement (*see* Ch 2,5.3). In the case of continuous casting, test samples representing both the beginning and the end of the ~~charge~~ heat are to be taken. In the case of ingot casting, test samples representing two different ingots are to be taken.

Chapter 4

Aluminium Alloys

CORRIGENDA

■ *Section 1*

General requirements

1.7 Visual and non-destructive examination

1.7.5 All castings are to be presented to the Surveyor for visual examination. Where applicable, this is to include the examination of internal surfaces. Castings are to be subject to magnetic particle examination or dye penetrant inspection (for austenitic stainless steel castings, *see* Section 8) in accordance with 1.7.9, unless more specific requirements for ~~non-destrutive~~ non-destructive examination are included in subsequent Sections of this Chapter, other parts of the Rules or the agreed specification.

1.11 Certification of materials

1.11.2 The manufacturer is to provide the Surveyor with a written statement giving the following particulars for each casting or batch of castings which has been accepted:

(a) Purchaser's name and order number.
(b) Description of castings and steel grade.
(c) Identification number.
(d) ~~Steel making~~ Steel-making process, cast number, chemical analysis of ladle samples and, in the case of the Special grade (*see* Section 2), the chemical analysis of the product or test bar.
(e) General details of heat treatment including the temperature and time at temperature.
(f) Results of mechanical tests.
(g) Test pressure, where applicable.

Chapter 5

Steel Forgings

CORRIGENDUM

■ *Section 1*

General requirements

1.11 Certification of materials

1.11.2 The manufacturer is to provide the Surveyor with a written statement giving the following particulars for each forging or batch of forgings which has been accepted:

(a) Purchaser's name and order number.
(b) Description of forgings and steel quality.
(c) Identification number.
(d) ~~Steelmaking~~ Steel-making process, cast number and chemical analysis of ladle samples.
(e) General details of heat treatment.
(f) Results of mechanical tests.
(g) Test pressure, where applicable.

Chapter 8

Aluminium Alloys

Effective date 1 January 2013 & CORRIGENDA

■ *Section 1*

Plates, bars and sections

1.7 Test material

1.7.5 If the material is supplied in the heat treated condition, each batch is to be treated together in the same furnace ~~charge~~ or subjected to the same finishing treatment when a continuous furnace is used.

Table 8.1.3 Minimum mechanical properties for acceptance purposes of selected rolled aluminium alloy products

Alloy and temper condition (*see* Note 3)	Thickness, *t*, mm	0,2% proof stress R_p, N/mm^2	Tensile strength R_m N/mm^2	Elongation ~~on $5{,}65\sqrt{S_o}$~~ $4d$, %	Elongation on $5{,}65\sqrt{S_o}$ %
5083-O	$3 \le t \le 50$ (*see* Note ~~3~~) 2	125	275–350	16	14
5083-H111	$3 \le t \le 50$	125	275–350	16	14
5083-H112	$3 \le t \le 50$	125	275	12	10
5083-H116	$3 \le t \le 50$	215	305	10 ~~(see Note 1)~~	10
5083-H321	$3 \le t \le 50$	215–295	305–380	12	10
5086-O	$3 \le t \le 50$	100	240–305	16	14
5086-H111	$3 \le t \le 50$	100	240–305	16	14
5086-H112	$3 \le t \le 12{,}5$ $12{,}5 < t \le 50$	125 105	250 240	8 —	— 9
5086-H116	$3 \le t \le 50$	195	275	10 (*see* Note ~~2~~ 1)	9
5059-O	$3 \le t \le 50$	160	330	24	24
5059-H111	$3 \le t \le 50$	160	330	24	24
5059-H116	$3 \le t \le 20$ $20 < t \le 50$	270 260	370 360	10 10	10 10
5059-H321	$3 \le t \le 20$ $20 < t \le 50$	270 260	370 360	10 10	10 10
5383-O	$3 \le t \le 50$	145	290	17	17
5383-H111	$3 \le t \le 50$	145	290	17	17
5754-H111	$3 \le t \le 50$	80	190–240	18	17
5383-H116	$3 \le t \le 50$	220	305	10	10
5383-H321	$3 \le t \le 50$	220	305	10	10
5456-O	$3 \le t \le 6{,}3$ $6{,}3 \le t \le 50$	130–205 125–205	290–365 285–360	16 16	— 14
5456-H116	$3 \le t \le 30$ $30 < t \le 40$ $40 < t \le 50$	230 215 200	315 305 285	10 — —	10 10 10
5456-H321	$3 \le t \le 12{,}5$ $12{,}5 \le t \le 40$ $40 \le t \le 50$	230–315 215–305 200–295	315–405 305–385 285–370	12 — —	— 10 10
5754-O	$3 \le t \le 50$	80	190–240	18	17

NOTES

~~1. 10% for thickness up to and including 12,5 mm.~~

~~2~~ 1. ~~10%~~ 8% for thickness up to and including ~~12,5~~ 6,3 mm.

~~3~~ 2. For application to liquefied natural gas carriers or liquefied natural gas tankers where thicknesses are in excess of 50 mm, the mechanical properties given in this table are, in general, to be complied with.

3. The mechanical properties for the O and H111 tempers are the same for all alloys shown in this Table. However, they are separated in this Table as they are made using different manufacturing processes.

Table 8.1.4 **Minimum mechanical properties for acceptance purposes of selected extruded aluminium alloy products** (*Part only shown*)

Alloy and temper condition (*See* Note 2)	Thickness, *t*, mm	0,2% proof stress R_p, N/mm^2	Tensile strength R_m N/mm^2	Elongation ~~on 5,65 $\sqrt{S_o}$~~ 4*d*, %	Elongation on 5,65 $\sqrt{S_o}$, %

NOTES
1. The values are applicable for longitudinal and transverse tensile test specimens as well.
2. The mechanical properties for the O and H111 tempers are the same for all alloys shown in this Table. However, they are separated in this Table as they are made using different manufacturing processes.

1.9 Corrosion tests

1.9.1 Rolled 5000 series alloys of type 5083, 5383, 5059, 5456 and 5086 in the H111, H112, H116 and H321 tempers intended for use in marine hull construction or in marine applications with frequent direct contact with seawater are to be corrosion tested with respect to exfoliation and intergranular corrosion resistance.

1.9.2 The manufacturer is to establish the relationship between microstructure and resistance to corrosion when the above alloys are approved. A reference photomicrograph taken at 500x, under the conditions specified in ASTM B928 Section 9.4.1, is to be prepared for each of the alloy-tempers and thickness ranges relevant. The reference photographs are to be taken from samples which have exhibited no evidence of exfoliation corrosion and a pitting rating of PB or better, when subjected to the test described in ASTM G66 (ASSET).The samples are also to have exhibited resistance to intergranular corrosion at a mass loss no greater than 15 mg/cm^2, when subjected to the test described in ASTM G67 (NAMLT). Upon satisfactory establishment of the relationship between microstructure and resistance to corrosion, the master photomicrographs and the results of the corrosion tests are to be approved by LR. Production practices are not to be changed after approval of the reference micrographs.

1.9.3 For batch acceptance of 5000 series alloys in the H116 and H321 tempers, metallographic examination of one sample selected from mid width at one end of a coil or random sheet or plate is to be carried out. The microstructure of the sample is to be compared to the reference photomicrograph of acceptable material in the presence of the Surveyor. A longitudinal section perpendicular to the rolled surface is to be prepared for metallographic examination, under the conditions specified in ASTM B928 Section 9.6.1. If the microstructure shows evidence of continuous grain boundary network of aluminium-magnesium precipitate in excess of the reference photomicrographs of acceptable material, the batch is either to be rejected or tested for exfoliation corrosion resistance and intergranular corrosion resistance subject to the agreement of the Surveyor. The corrosion tests are to be in accordance with ASTM G66 and G67 or equivalent standards. ~~If the results from testing satisfy the acceptance criteria stated in 1.9.2 the batch is accepted, otherwise it is to be rejected.~~ Acceptance criteria are that the sample shall exhibit no evidence of exfoliation corrosion and a pitting rating of PB or better when test subjected to ASTM G66 (ASSET) test, and the sample is to exhibit resistance to intergranular corrosion at a mass loss no greater than 15 mg/cm^2 when subjected to ASTM G67 (NAMLT) test. If the results from testing satisfy the acceptance criteria stated in 1.9.2, the batch is accepted, otherwise it is to be rejected.

1.9.4 As an alternative to metallographic examination, each batch may be tested for exfoliation corrosion resistance and intergranular corrosion resistance, in accordance with ASTM G66 and G67 ~~or equivalent standards.~~ under the conditions specified in ASTM B298, or equivalent standards. If this alternative is used, then the results of the test must satisfy the acceptance criteria stated in 1.9.2.

1.14 Certification of materials

(*Part only shown*)

1.14.2 Each test certificate is to include the following particulars:

(k) Corrosion test results (as applicable).

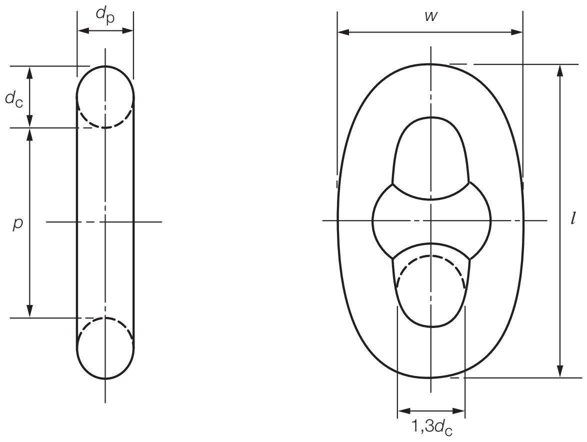
Chapter 10

Equipment for Mooring and Anchoring

CORRIGENDA

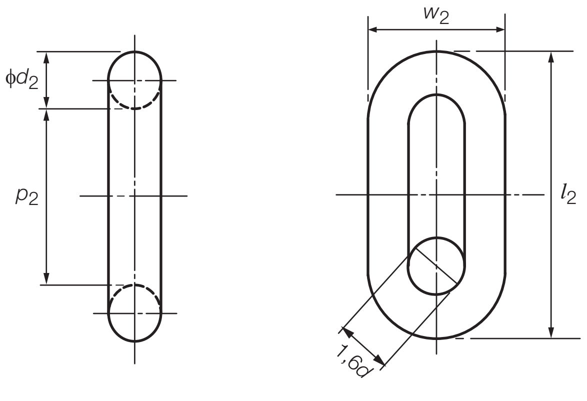
■ *Section 2*
Stud link chain cables for ships

2.15 Dimensions and tolerances



d = nominal diameter $\left(\dfrac{d_c + d_p}{2}\right)$
d_c = nominal diameter at crown measured in plane of link
d_p = nominal diameter at crown measured perpendicular to plane of link
l = $6d_c$
p = $4d_c$
w = $3{,}6d_c$ to the nearest millimetre

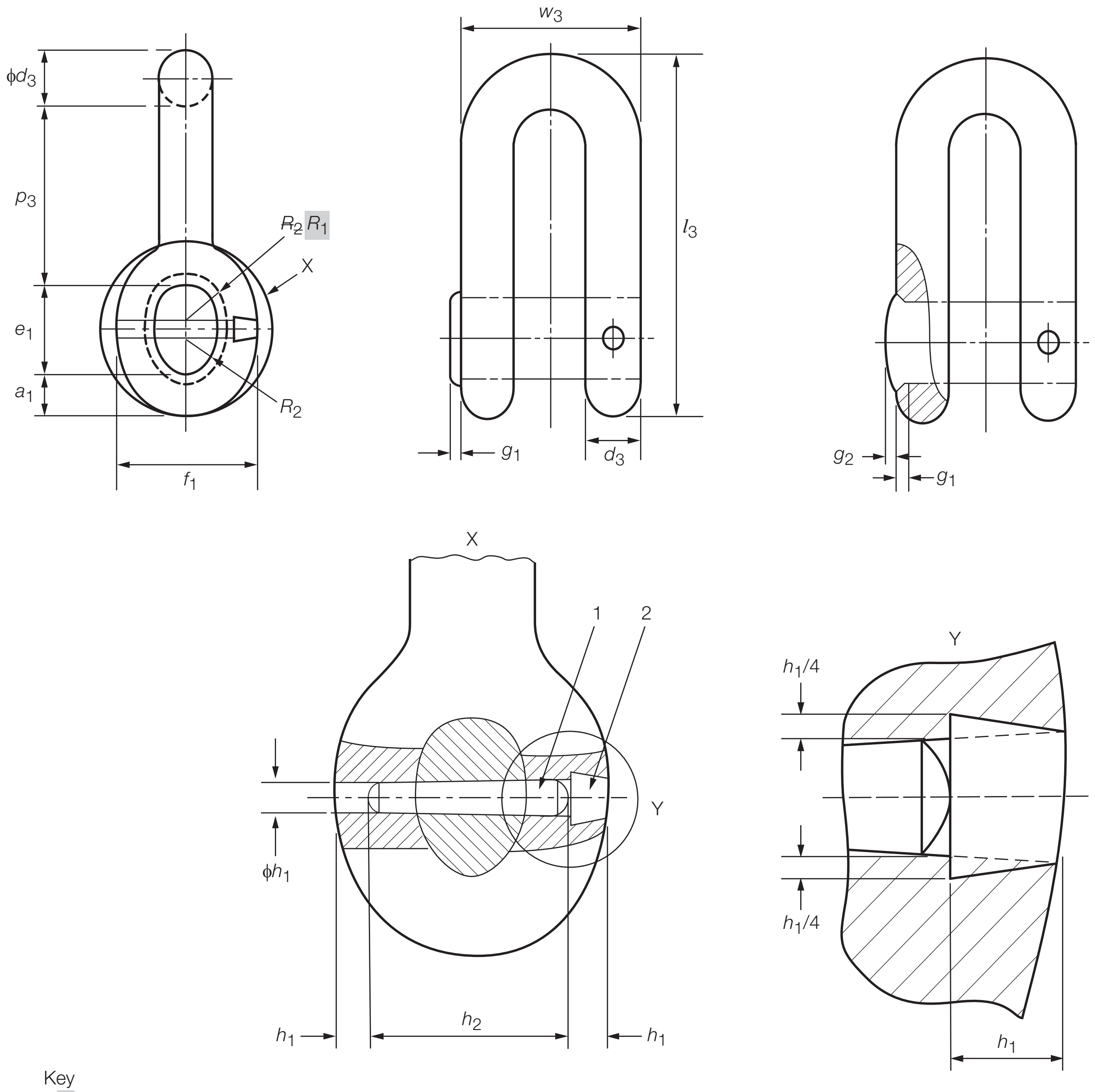
Fig. 10.2.1 Common link



d = nominal diameter of common stud link
d_2 = nominal diameter of end link = $1{,}2d$ ~~$(d_2 - 1{,}2d)$~~
$(d_2 = 1{,}2d)$

l_2 = $p_2 + 2d_2 \approx 6{,}75d$
p_2 = $3{,}65d_2 \approx 4{,}35d$
w_2 = $3{,}3d_2 \approx 4d$

Fig. 10.2.3 End link

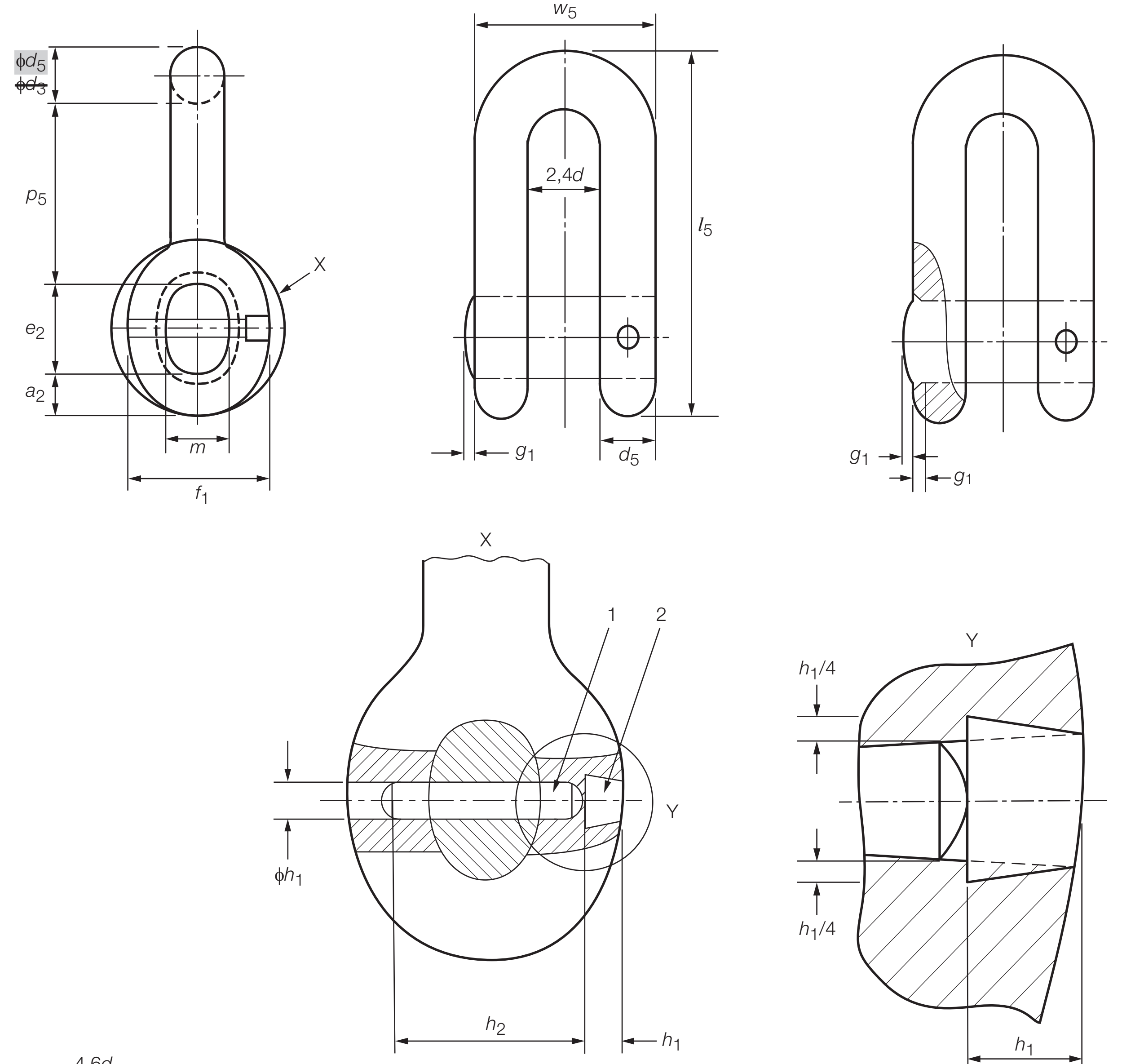


Key
~~X~~ 1 retaining pin
~~Y~~ 2 dovetail chamber

d = nominal diameter of common stud link
d_3 = nominal diameter of joining shackle = 1,3d
l_3 = 7,1d
p_3 = $l_3 - (d_3 + a_1 + e_1)$ = 3,4d
w_3 = 4d
a_1 = 0,8d
e_1 = 1,6d

f_1 = 2,8d
g_1 = 0,2d
g_2 = 0,1d
h_1 = nominal diameter of taper pin
h_2 = nominal length of taper pin
R_1 = 0,6d
R_2 = 0,5d

Fig. 10.2.4 ~~End~~ Dee shackle



4,6d

Key

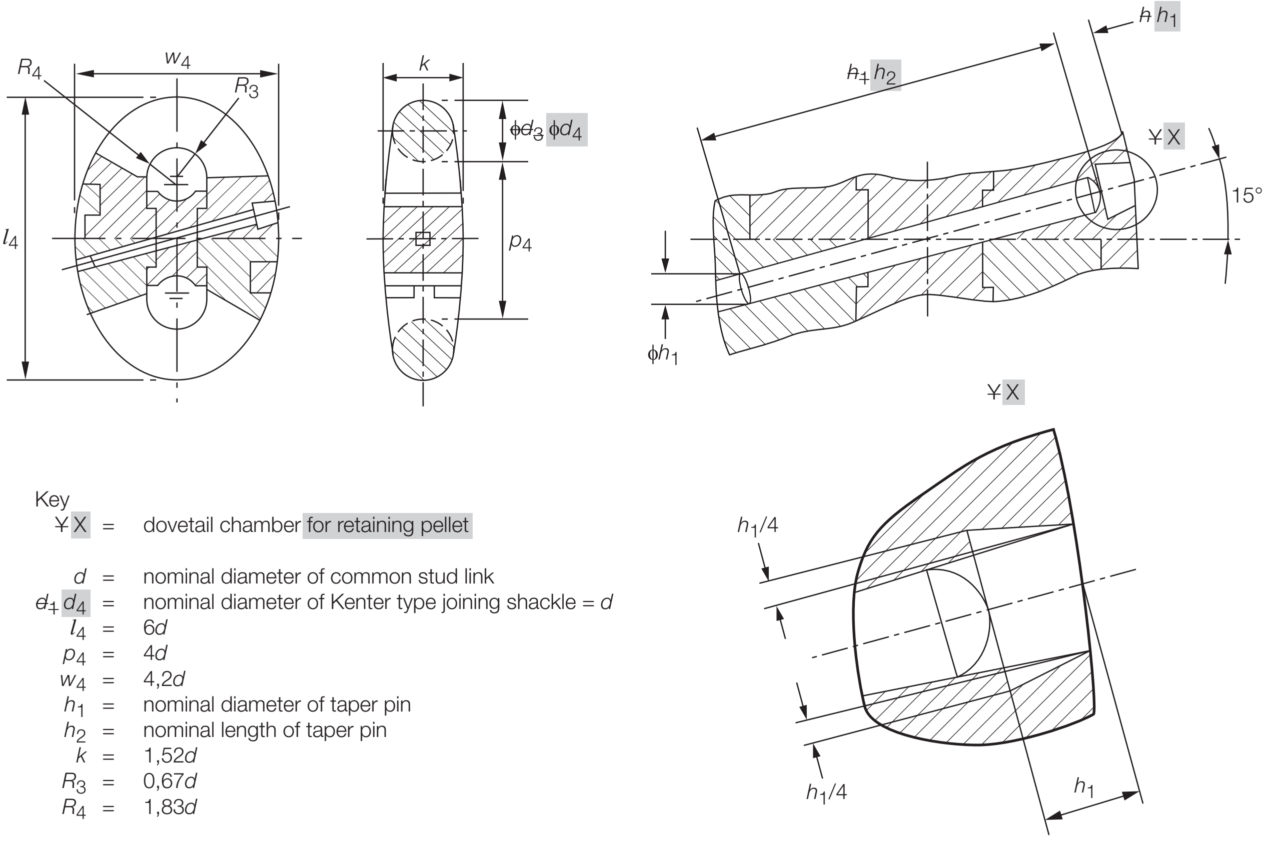
~~X~~ 1 retaining pin

~~Y~~ 2 dovetail chamber

d = nominal diameter of common stud link
d_5 = nominal diameter of end shackle = 1,4d
l_5 = 8,7d
p_5 = l_5 – (~~d_3~~ d_5 + a_2 + e_2) = ~~4,5d~~ 4,6d
w_5 = 5,2d
a_2 = 0,9d
e_2 = 1,8d

f_2 = 3,1d
g_1 = 0,2d
g_2 = 0,1d
m = 1,4d
h_1 = nominal diameter of taper pin
h_2 = nominal length of taper pin

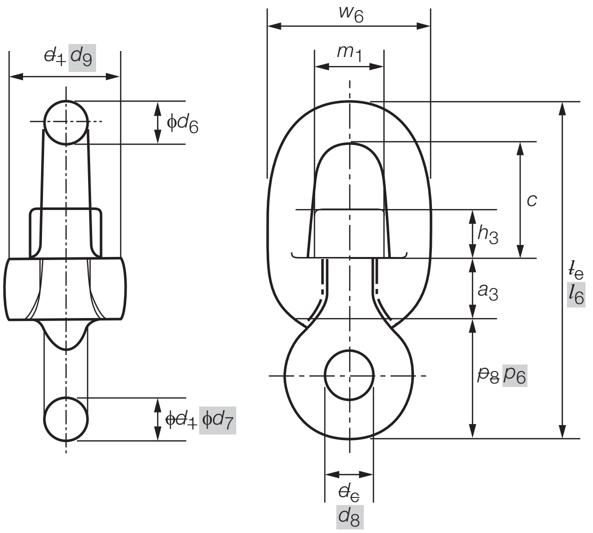
Fig. 10.2.5 ~~Dee~~ End shackle



Key
~~Y~~ X = dovetail chamber for retaining pellet

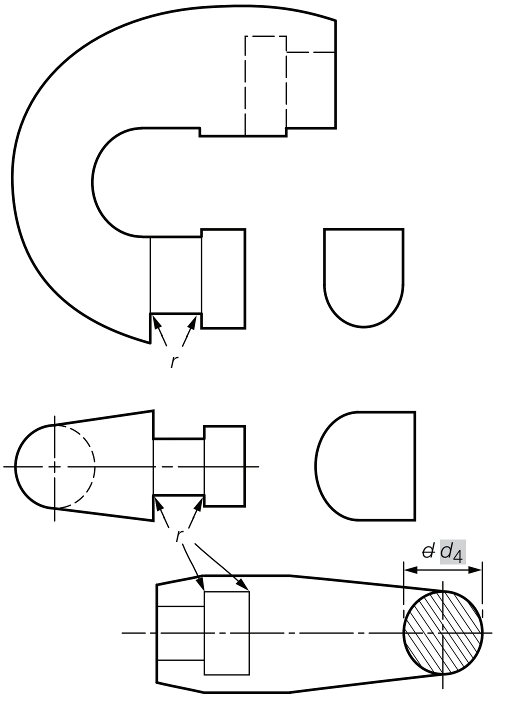
d = nominal diameter of common stud link
~~d_1~~ d_4 = nominal diameter of Kenter type joining shackle = d
l_4 = $6d$
p_4 = $4d$
w_4 = $4{,}2d$
h_1 = nominal diameter of taper pin
h_2 = nominal length of taper pin
k = $1{,}52d$
R_3 = $0{,}67d$
R_4 = $1{,}83d$

Fig. 10.2.6 Lugless shackle



d = nominal diameter of common stud link
d_6 = nominal diameter of swivel = $1{,}2d$
~~l_e~~ l_6 = $9{,}7d$
~~p_e~~ p_6 = ~~d_9~~ – d_9 = $3{,}4d$
w_6 = $4{,}7d$
d_7 = $1{,}1d$
a_3 = ~~$1{,}76d$~~ $1{,}75d$
m_1 = $2d$
h_3 = ~~d_9~~ – d_8 = $1{,}4d$
c = $3{,}35d$

Fig. 10.2.7 Swivel



The radii indicated by r are to be not less than 0,03 x ~~d~~ d_4

Fig. 10.2.8 Lugless shackle of the Kenter type

Chapter 12

Welding Qualifications

Effective date 1 January 2013

Section 2

Welding Procedure Qualification Tests for Steels

2.15 Range of approval

Table 12.2.4 Range of approval for different types of butt joints

Type of welded joint for test assembly				Range of approval
Butt welding	One side	With backing	A	A,C,~~D~~
		Without backing	B	A,B,C,D
	Both sides	With gouging	C	C
		Without gouging	D	C,D

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